Maryland Department of Natural Resources




Green Infrastructure and GreenPrint

Targeting and Conserving Maryland's Most Ecologically Important Lands

Christine Conn
Office for a Sustainable Future

MARYLAND DEPARTMENT OF NATURAL RESOURCES

What is Infrastructure?

Infrastructure – "*the substructure or underlying foundation on which the continuance and growth of a community depends*"

- Webster's New World Dictionary

- A **necessity**, not an amenity
- A primary public **investment**
- Must be constantly **maintained**
- Must be developed as a **system**, not as isolated parts

What is Green Infrastructure?

"Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem functions, and provide associated benefits to human populations"

Our # 1 Conservation Challenge

Accelerated Consumption and Fragmentation of Natural and Working Lands

Source: Audubon Magazine, March/April 2000

Green Infrastructure Assessment

The Land Plan Science

What is it?

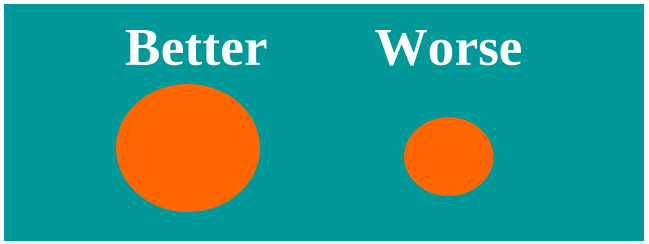
- A GIS analysis developed to help identify and prioritize areas for
  - Conservation,
  - Restoration, and
  - Smart Growth

The Benefit:

- Provides a consistent, objective and defensible approach to land management decisions

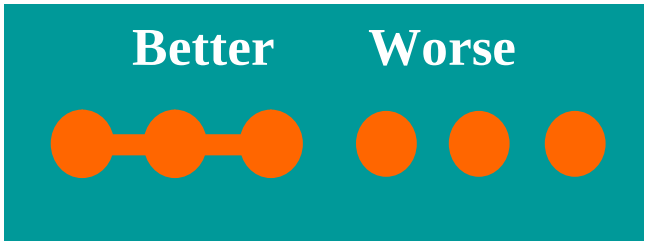
Design Principles

- Conservation Biology



Larger vs. smaller

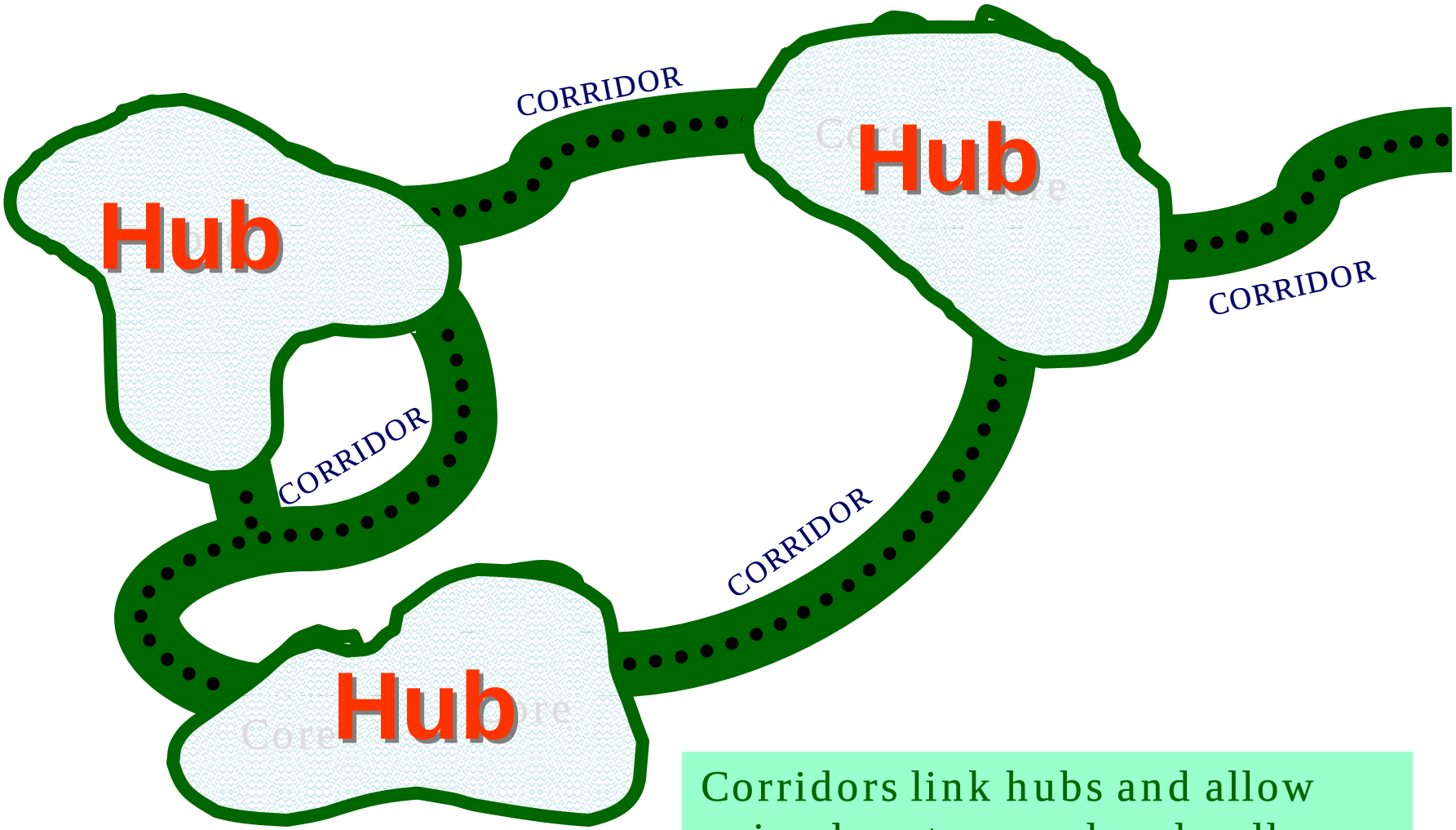
- Landscape Ecology



Connections are better

Forest Interior Dependent Species (FIDS)

The Network Concept



Corridors link hubs and allow animal, water, seed and pollen movement between hubs

Geographic Information Systems (GIS) Analysis

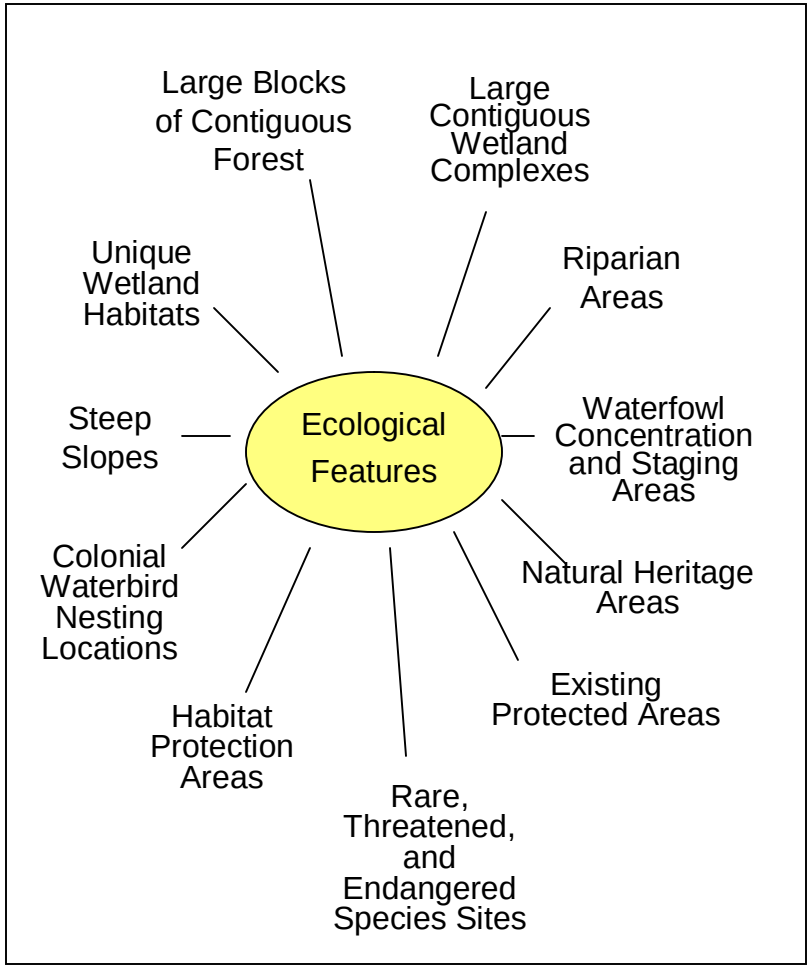
Selection of Ecological Components

Strive to include full range of ecosystem elements vs single species focus

Consultation with

- MD Biological Stream Survey
- Wildlife and Heritage
- Forest Service
- Scientific Community

Limited to features with GIS data available statewide



Green Infrastructure Assessment

Hubs

250 acres or

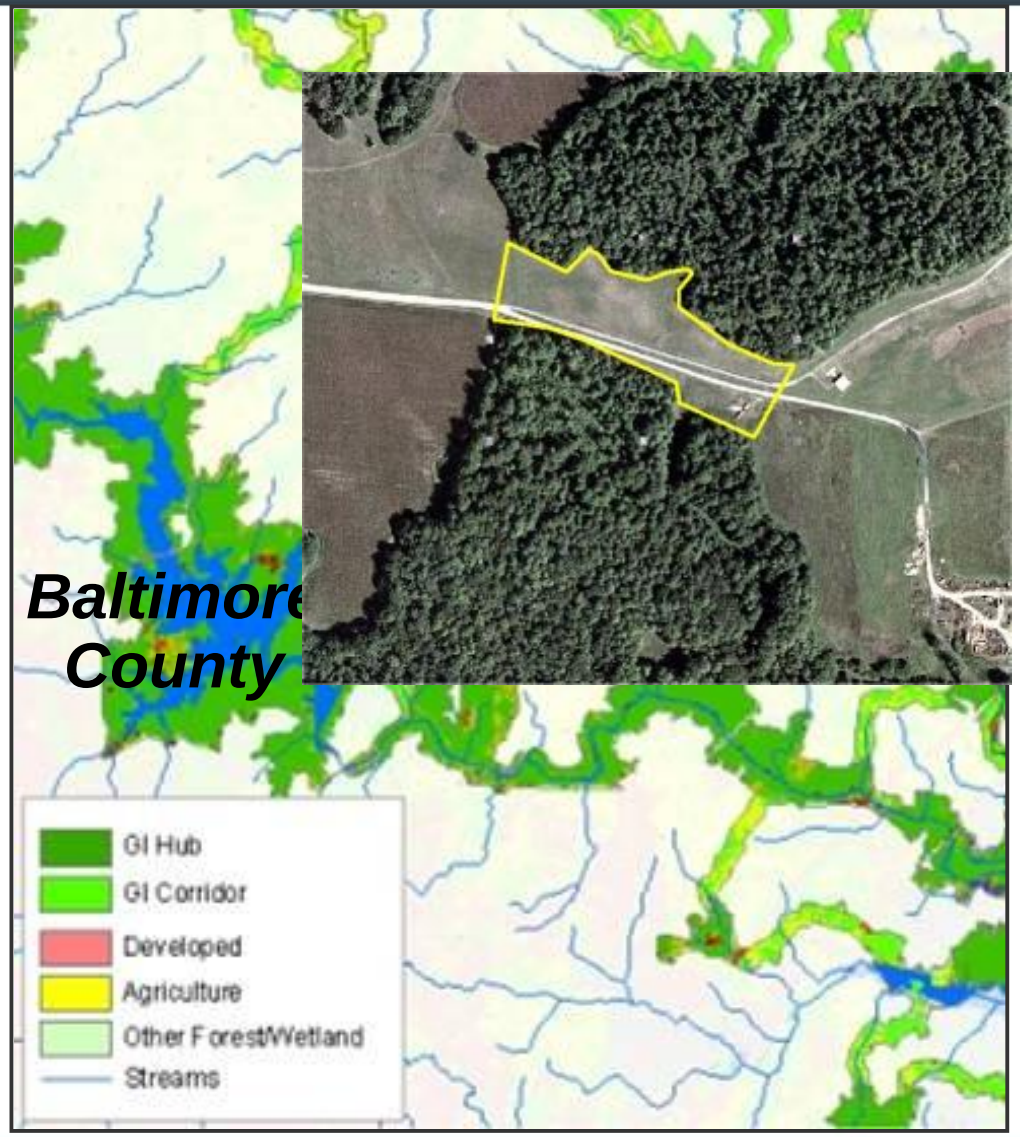
Important habitat > 100 acres

Corridors

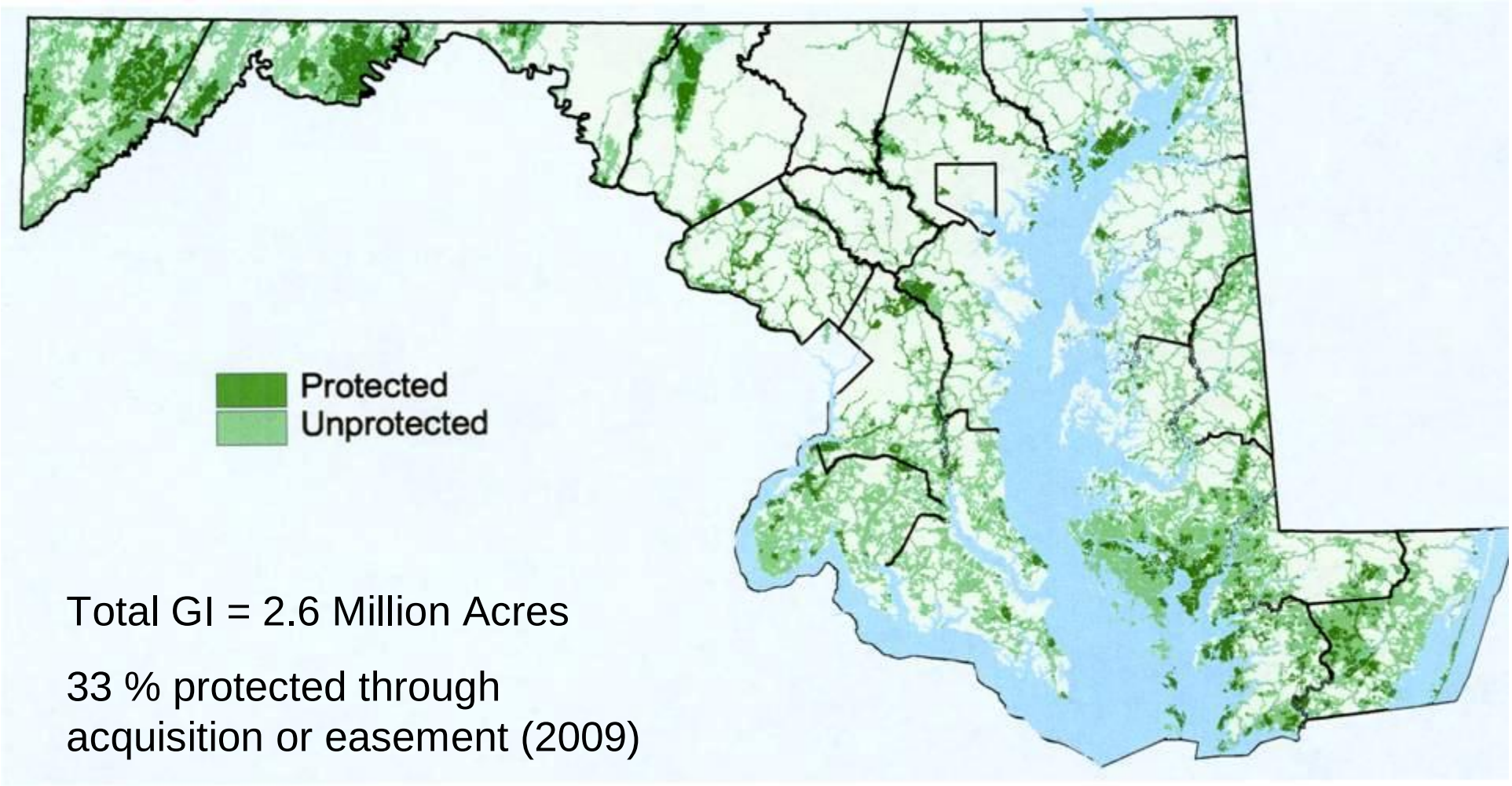
1100 feet or FEMA floodplain

Gaps

Restoration opportunities



A Statewide Network



Total GI = 2.6 Million Acres

33 % protected through acquisition or easement (2009)

Ecological Importance of Hubs

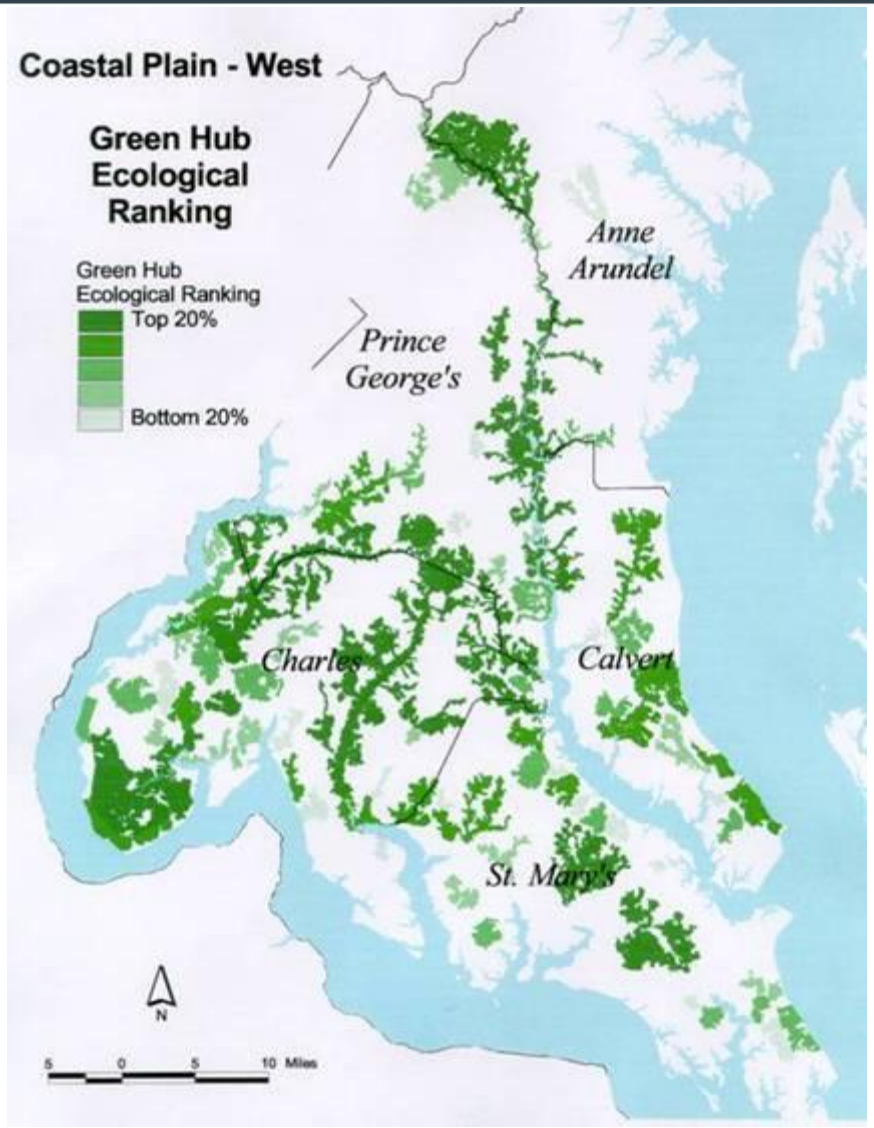
Hubs ranked using multiple ecological factors

Parameter	Weight
Proportion of internal gaps	4
Area of upland Natural Heritage Areas	5
Area of WSSC and wetland or aquatic NHA	5
Area of upland interior forest	4
Area of wetland interior forest	4
Area of other wetlands	3
Length of streams within interior forest	4
Number of stream nodes (sources and junctions)	2
Fish IBI score	1
Benthic invertebrate IBI score	1
Aquatic species of concern	2
Presence of brook trout	1
Anadromous fi	1
Area of SSPRA	2
Presence of S	2
Percent upland	4
Standard deviation of elevation	1
Number of different NWI wetland types	1
Number of different natural soil groups	1
Number of different physiographic regions	1
Mean distance to the nearest primary or secondary road	3
Density of interstate, state, and county roads	3
Area of highly erodible soils	2
Area of proximity zone outside hub	2
Nearest neighboring hub distance	3
Shape index	1
Surrounding buffer suitability (within 300' of hub)	1
Interior forest within 10 km of hub periphery	1
Marsh within 10 km of hub periphery	1

Corridors were ranked in a similar manner, only using different factors

Targeting Actions

Ecological Importance of Hubs



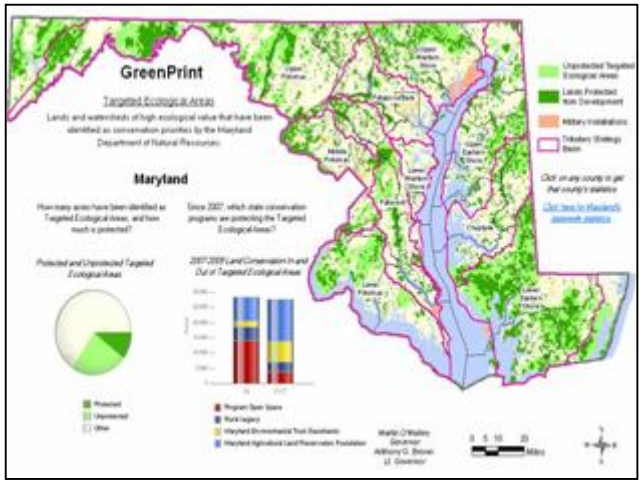
Maryland Department of Natural Resources

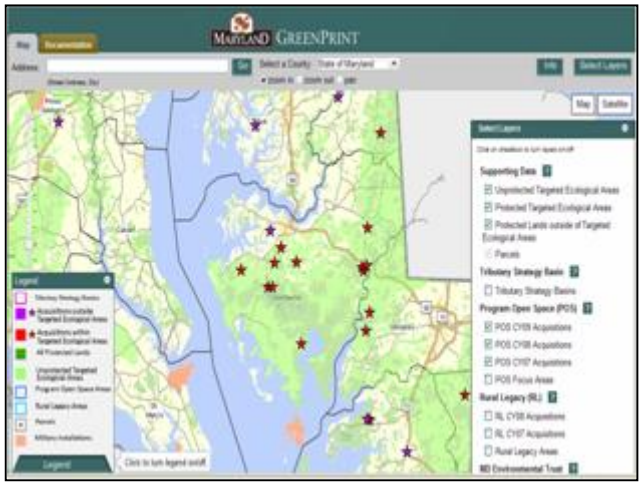
Maryland's GreenPrint

A Mapping Tool for Land Conservation Planning

GreenPrint…

- Is an interactive mapping tool
- Sets ecological targets and goals
- Tracks success
- Measures accountability
- Encourages public and private partnership



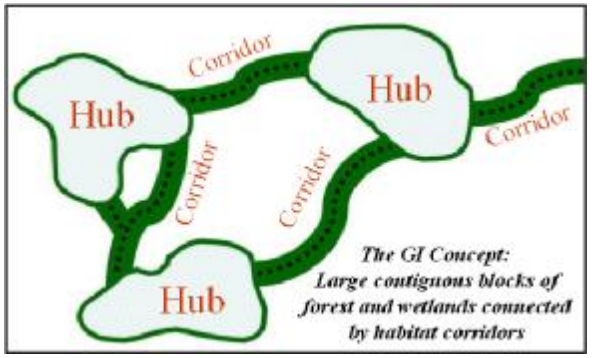


Targeted Ecological Areas are…

- The most ecologically valuable areas in the State: the "Best of the Best"
- Identified by Maryland Department of Natural Resources ecologists
- Designated as conservation targets for Program Open Space

Identifying Targeted Ecological Areas

- Maryland's Green Infrastructure Assessment
  - An ecological network of the State's most important large blocks of forests and wetlands and the habitat corridors needed to connect them



Identifying Targeted Ecological Areas

- Aquatic Life Hotspots
  - Watersheds that support areas of high aquatic biodiversity and fish species sensitive to increases in impervious surfaces

Identifying Targeted Ecological Areas

- Rare Species Habitat
  - Areas that support Rare, Threatened and Endangered species and other unique plant and animal communities

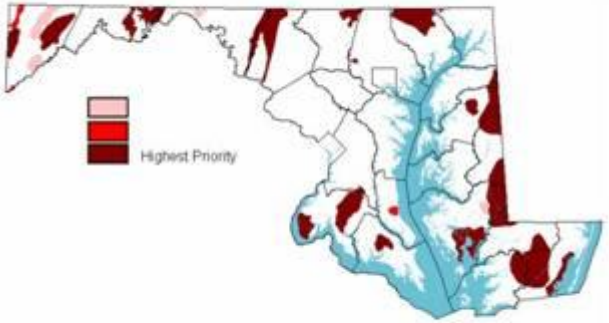
Identifying Targeted Ecological Areas

- Water Quality Protection
  - Sensitive watershed lands, such as forests, wetlands, and steep slopes that are important for providing water quality services

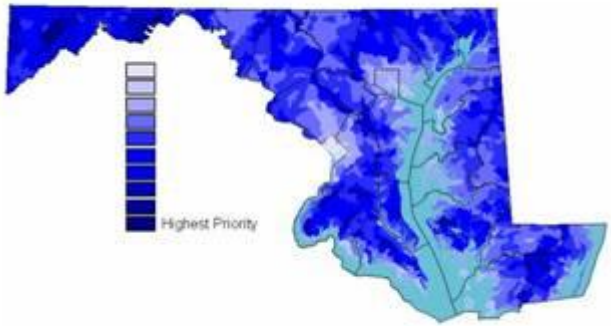
Identifying "Targeted Ecological Areas" Best of the Best

Green Infrastructure

Rare Species Habitats

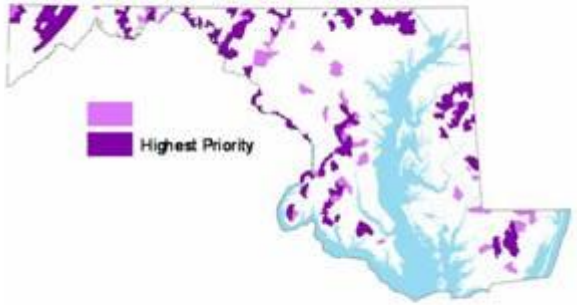


Water Quality Protection

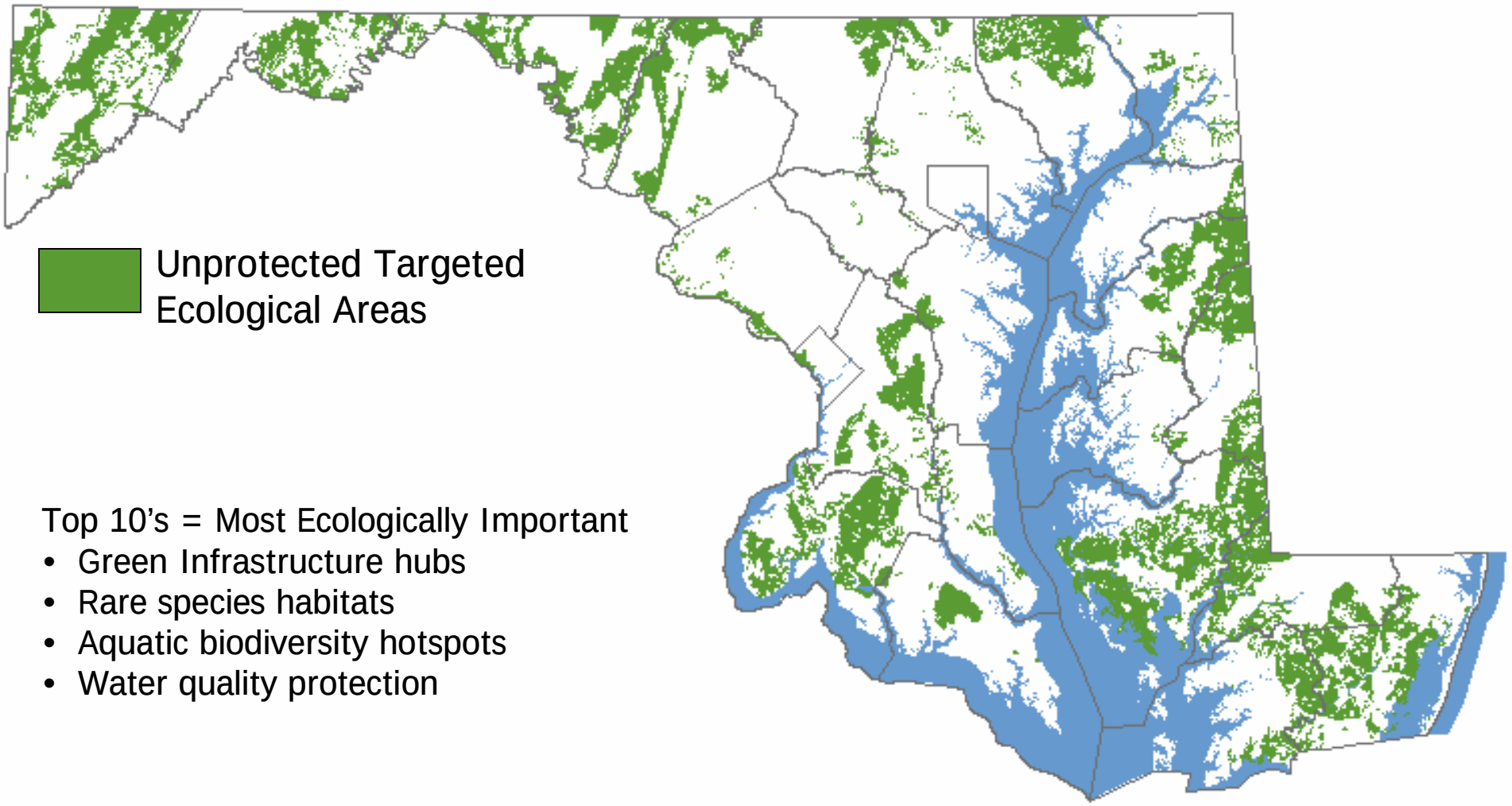


Targeted Ecological Areas

Aquatic Life Hotspots



Targeted Ecological Areas



Top 10's = Most Ecologically Important

- Green Infrastructure hubs
- Rare species habitats
- Aquatic biodiversity hotspots
- Water quality protection

2.1 Million Acres (1.5 million acres unprotected)

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Smart, Green & Growing

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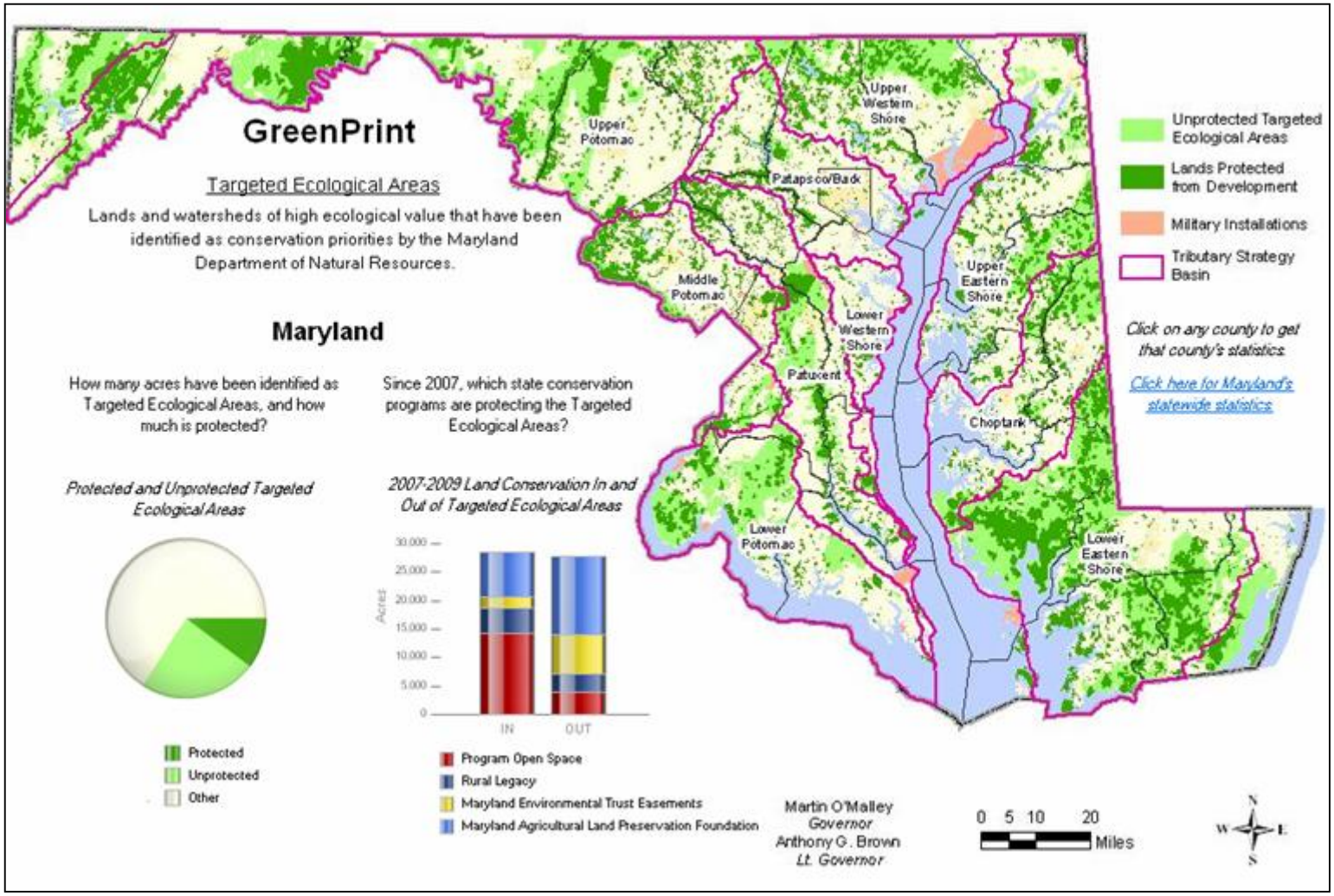
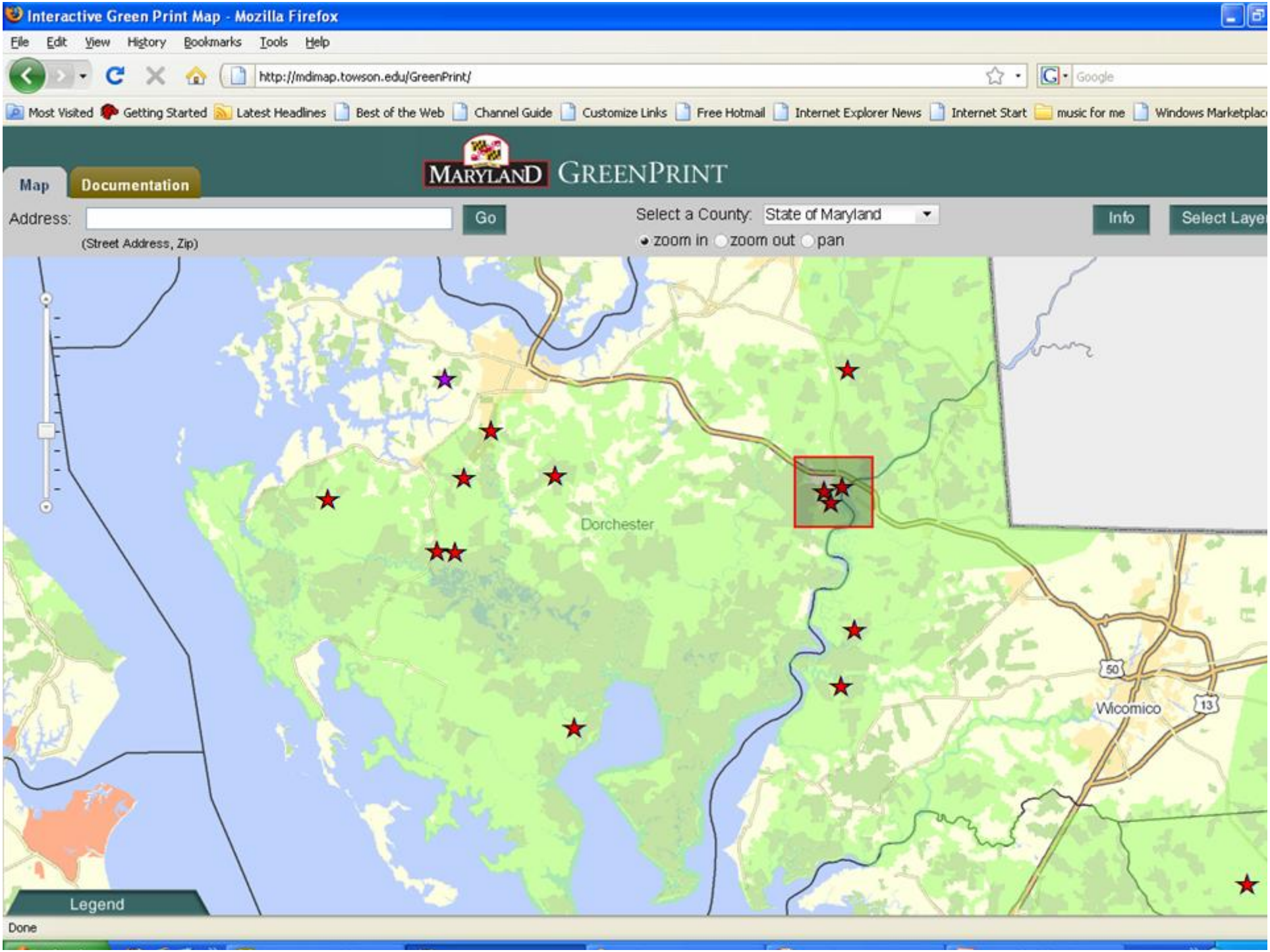
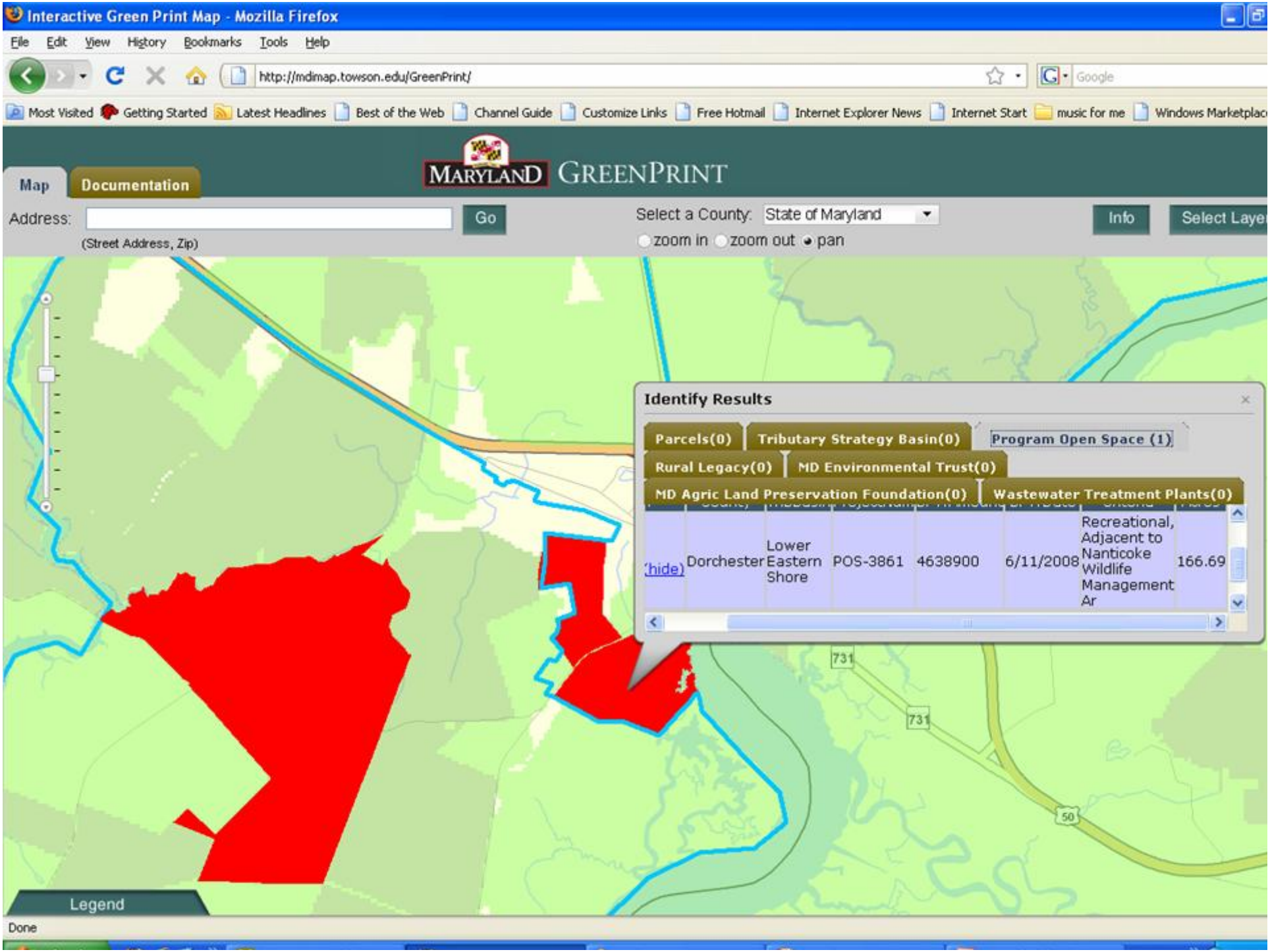

GreenPrint
Targeted Ecological Areas
Lands and watersheds of high ecological value that have been identified as conservation priorities by the Maryland Department of Natural Resources.
Maryland
How many acres have been identified as Targeted Ecological Areas, and how much is protected?
Since 2007, which state conservation programs are protecting the Targeted Ecological Areas?
Protected and Unprotected Targeted Ecological Areas
Protected
Unprotected
Other
2007-2009 Land Conservation In and Out of Targeted Ecological Areas
Acres
30,000
25,000
20,000
15,000
10,000
5,000
0
IN
OUT
Program Open Space
Rural Legacy
Maryland Environmental Trust Easements
Maryland Agricultural Land Preservation Foundation
Upper Potomac
Upper Western Shore
Patapsco/Back
Middle Potomac
Upper Eastern Shore
Lower Western Shore
Patuxent
Choptank
Lower Potomac
Lower Eastern Shore
Unprotected Targeted Ecological Areas
Lands Protected from Development
Military Installations
Tributary Strategy Basin
Click on any county to get that county's statistics
Click here for Maryland's statewide statistics
Martin O'Malley
Governor
Anthony G. Brown
Lt. Governor
0 5 10 20
Miles
N
W
E
S


Interactive Green Print Map - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://mdimap.towson.edu/GreenPrint/
Most Visited Getting Started Latest Headlines Best of the Web Channel Guide Customize Links Free Hotmail Internet Explorer News Internet Start music for me
Map
Documentation
MARYLAND GREENPRINT
Address:
Go
(Street Address, Zip)
Select a County: State of Maryland
zoom in zoom out pan
Info
Select Laye
Dorchester
Wicomico
50
13
Legend
Done

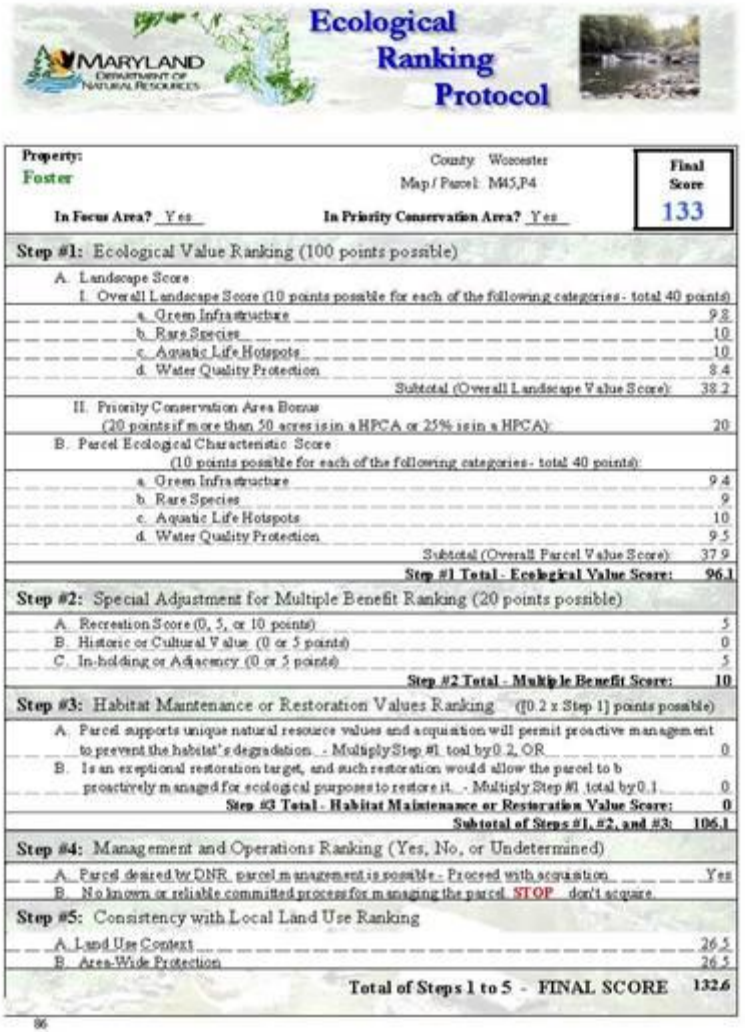

Interactive Green Print Map - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://mdmap.towson.edu/GreenPrint/
Most Visited Getting Started Latest Headlines Best of the Web Channel Guide Customize Links Free Hotmail Internet Explorer News Internet Start music for me Windows Marketplac
Map
Documentation
MARYLAND GREENPRINT
Address:
Go
(Street Address, Zip)
Select a County: State of Maryland
zoom in zoom out pan
Info
Select Laye
Identify Results
Parcels(0)
Tributary Strategy Basin(0)
Program Open Space (1)
Rural Legacy(0)
MD Environmental Trust(0)
MD Agric Land Preservation Foundation(0)
Wastewater Treatment Plants(0)
(hide)
Dorchester
Lower Eastern Shore
POS-3861
4638900
6/11/2008
Recreational, Adjacent to Nanticoke Wildlife Management Ar
166.69
731
731
50
Legend
Done

Ranking Parcel Opportunities

1. Ecological Value
    A. Landscape score
    B. Parcel score
2. Special Adjustments for Multiple Benefits
    A. Recreational, historic, or cultural value
    B. In-holding or adjacency
3. Habitat Maintenance or Restoration Value
    A. Active management needed to prevent degradation of unique natural resources
    B. Opportunities for habitat and water quality restoration
4. Management and Operations
    A. Responsibility for management has been identified
5. Consistency with Local Land Use
    A. Fragmentation due to development
    B. Vulnerability to additional development
    C. Level of threat
    D. Relevance of adjacent development

Conservation Scorecards created for each project

- Project scorecards and maps provided to the Board of Public Works
- Provides transparency and accountability
- Decisions based on ecologically defensible criteria



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Ecological Ranking Protocol

Property: Foster	County: Worcester Map / Parcel: M45,P4	**Final Score** 133
In Focus Area? Yes	**In Priority Conservation Area?** Yes	

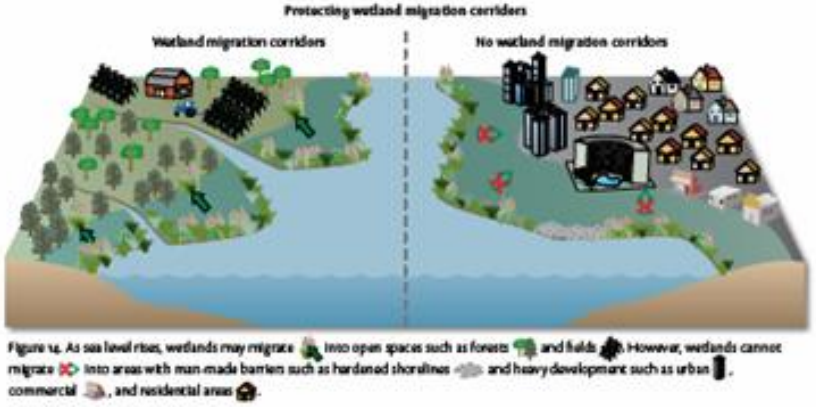
Step #1: Ecological Value Ranking (100 points possible)	
A. Landscape Score	
I. Overall Landscape Score (10 points possible for each of the following categories - total 40 points)	
a. Green Infrastructure	9.8
b. Rare Species	10
c. Aquatic Life Hotspots	10
d. Water Quality Protection	8.4
Subtotal (Overall Landscape Value Score):	38.2
II. Priority Conservation Area Bonus (20 points if more than 50 acres is in a HPCA or 25% is in a HPCA):	20
B. Parcel Ecological Characteristic Score (10 points possible for each of the following categories - total 40 points):	
a. Green Infrastructure	9.4
b. Rare Species	9
c. Aquatic Life Hotspots	10
d. Water Quality Protection	9.5
Subtotal (Overall Parcel Value Score):	37.9
Step #1 Total - Ecological Value Score:	**96.1**
Step #2: Special Adjustment for Multiple Benefit Ranking (20 points possible)	
A. Recreation Score (0, 5, or 10 points)	5
B. Historic or Cultural Value (0 or 5 points)	0
C. In-holding or Adjacency (0 or 5 points)	5
Step #2 Total - Multiple Benefit Score:	**10**
Step #3: Habitat Maintenance or Restoration Values Ranking ([0.2 x Step 1] points possible)	
A. Parcel supports unique natural resource values and acquisition will permit proactive management to prevent the habitat's degradation. - Multiply Step #1 total by 0.2, OR	0
B. Is an exceptional restoration target, and such restoration would allow the parcel to b proactively managed for ecological purposes to restore it. - Multiply Step #1 total by 0.1	0
Step #3 Total - Habitat Maintenance or Restoration Value Score:	**0**
Subtotal of Steps #1, #2, and #3:	**106.1**
Step #4: Management and Operations Ranking (Yes, No, or Undetermined)	
A. Parcel desired by DNR, parcel management is possible - Proceed with acquisition	Yes
B. No known or reliable committed process for managing the parcel. STOP - don't acquire.	
Step #5: Consistency with Local Land Use Ranking	
A. Land Use Context	26.5
B. Area-Wide Protection	26.5
Total of Steps 1 to 5 - FINAL SCORE	**132.6**

86

Additional Targeting Criteria

- Blue Infrastructure
  - Coastal and Tidal Habitats
  - Critical Natural Resources and
  - Associated Human Resources

- Climate Change Adaptation Benefits
  - Sea level rise and other climate change impacts



Blue Infrastructure & Sea Level Rise

Catherine McCall

Maryland Department of Natural Resources
Chesapeake & Coastal Program

A “Blue” Infrastructure

A detailed, systematic spatial assessment of coastal habitat, critical natural resources, and associated human uses in the tidal waters and near-shore area of Maryland’s coastal zone.

The link between our terrestrial-aquatic systems that helps target conservation and management.

Components of the Blue Infrastructure

Sensitive Species & Habitats

:

Sensitive Species + Shoreline-dependent Species, key spawning & nursery areas

Protected Lands & Stronghold Watersheds

:

Protected Lands + Impervious surface

Roads & Ditches

:

Hardened shorelines, fish blockages, point source discharge

Interior Forests & Marsh

:

Coastal marshes, SAV, oyster bars, beaches, sandy bottom

Near Shore Terrestrial Assessment

The shoreline is segmented for assessment of habitat, resources, and associated human uses related to:

-Near-shore land cover type

- Sensitive species, shoreline-dependent species

- Waterfowl concentration areas

- Shoreline stabilization

- Fish blockage, point-source discharge

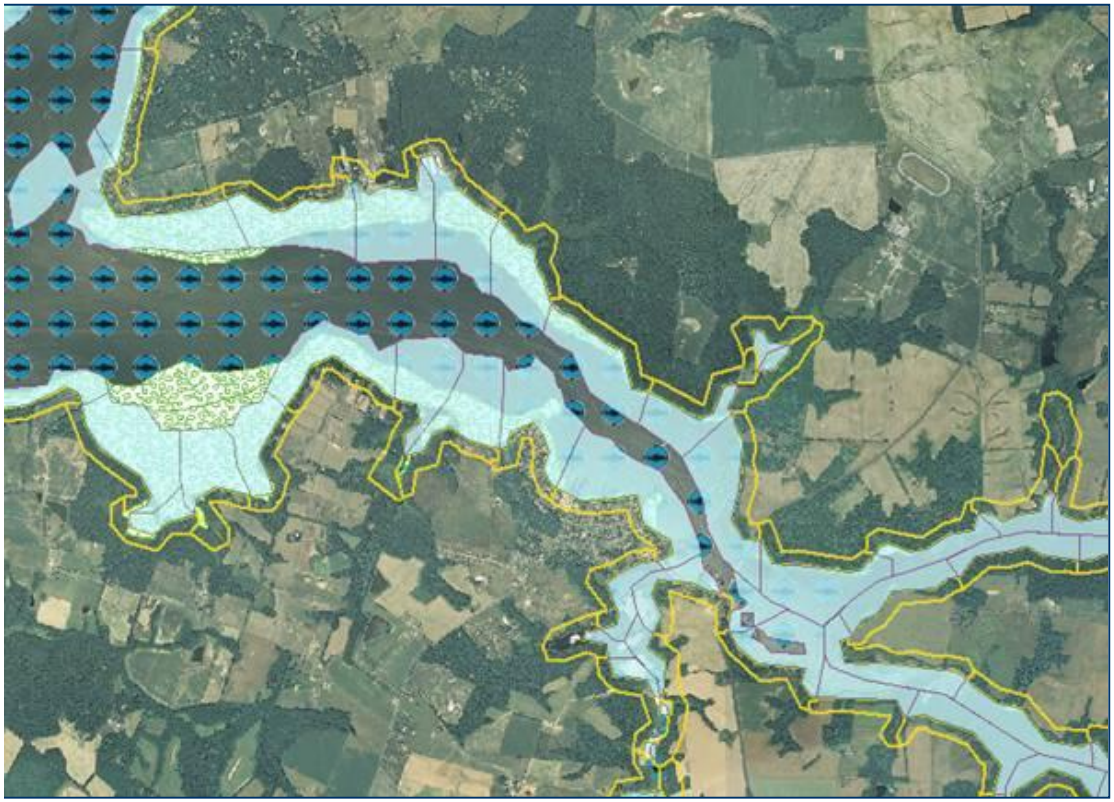
-BI tidal wetlands

Watershed Assessment

Shoreline segments are assigned watershed values based on characteristics of the 12-digit watershed in which they are located.

- Protected/Undeveloped Lands
- GI Lands
- Levels of Impervious Surface

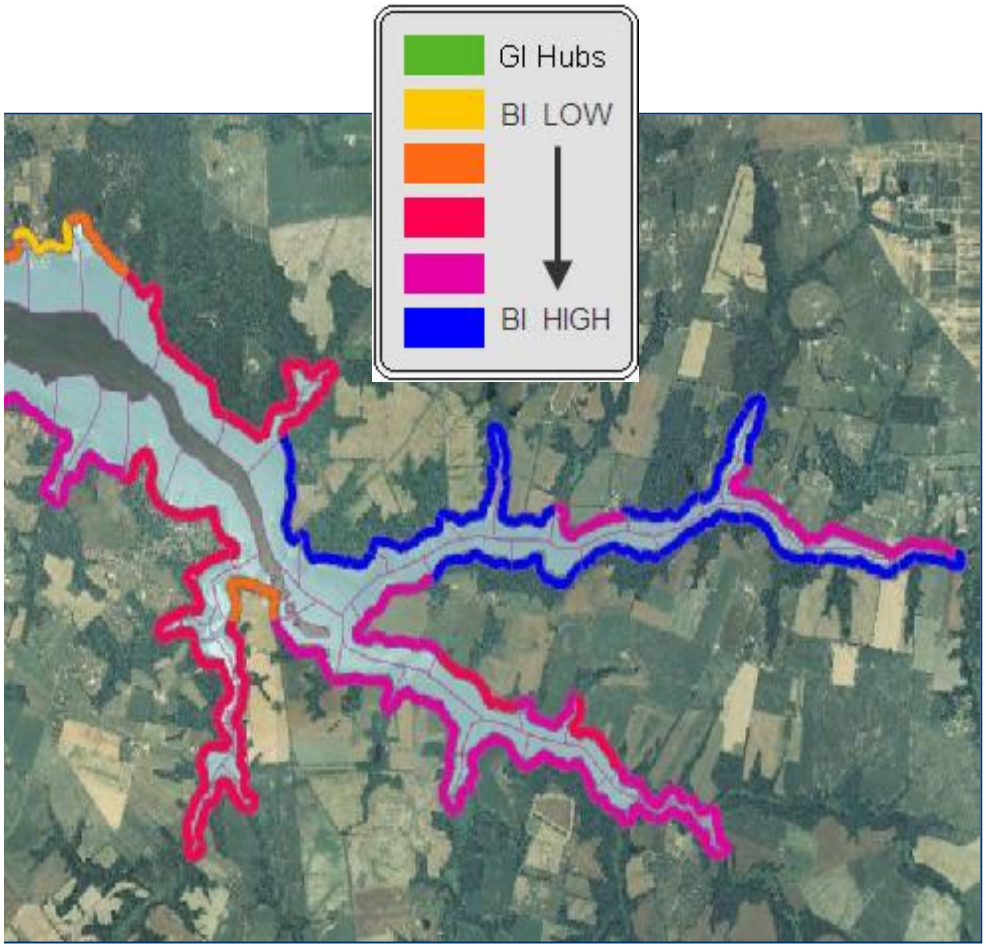
Near Shore Aquatic Assessment



A corresponding aquatic unit is assessed for habitat, natural resources, and human uses to a depth of 2m:

- Oyster sanctuaries and bars, other shellfish & closure areas
- Fish spawning/nursery areas
- Terrapin/Sandy beaches, horseshoe crabs, SAV
- Access structures

Resulting Assessment



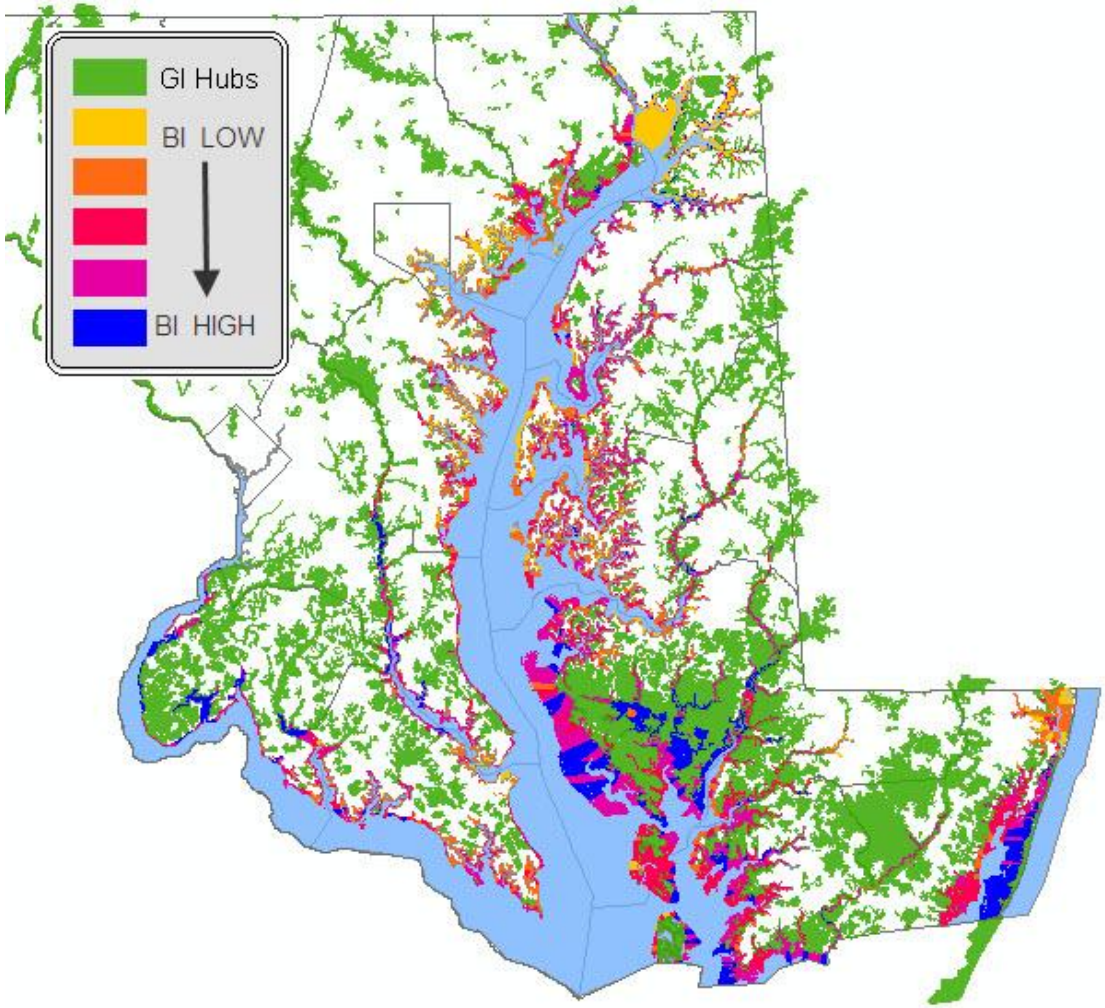
- Designed to incorporate estuarine priorities into targeting and land use planning and complement the Green Infrastructure network

- Represents...

  Watersheds and water quality criteria that support high aquatic biodiversity and fish species sensitive to increases in impervious surfaces

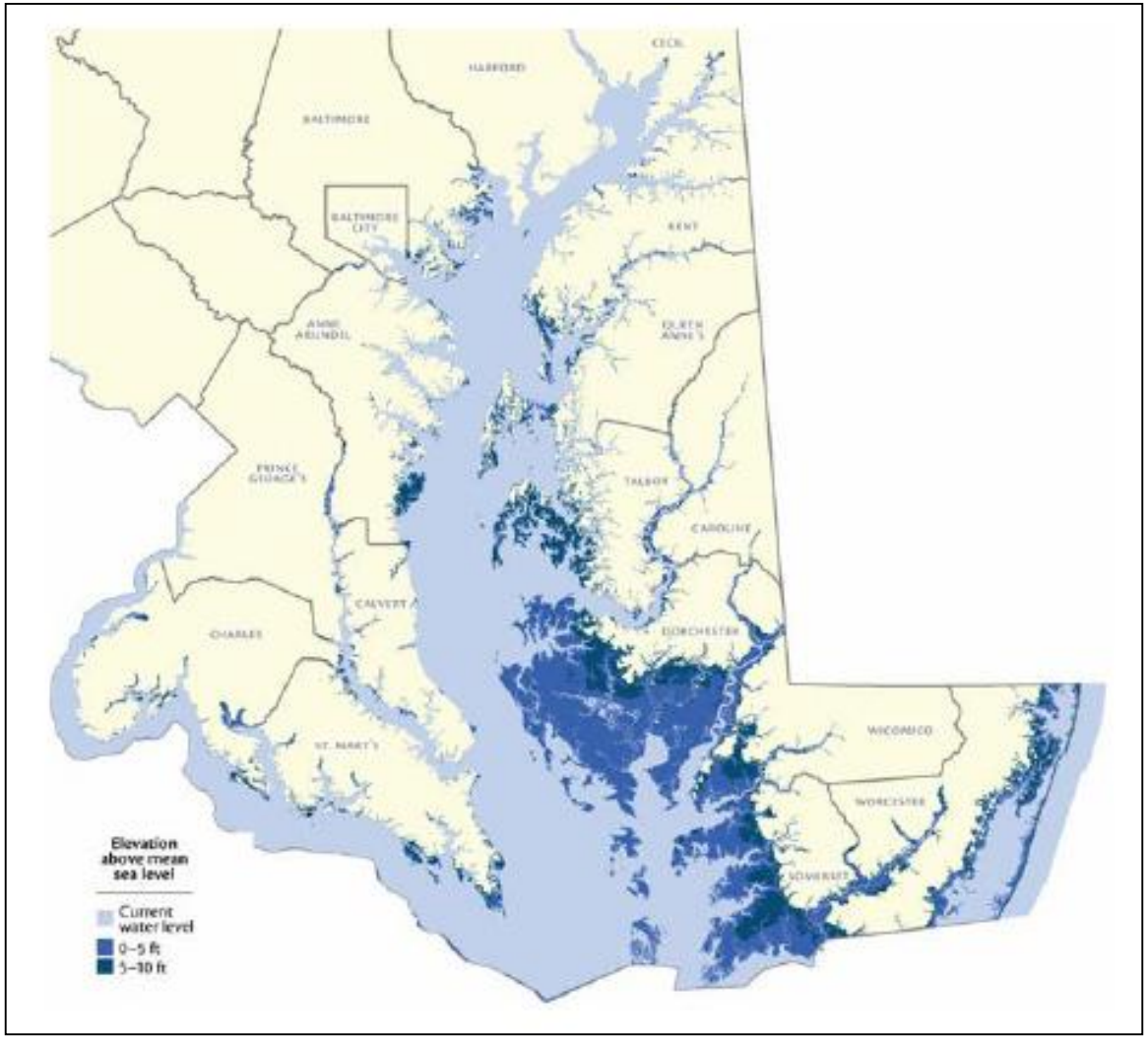
  Areas that support sensitive and shoreline-dependent species and other unique plant and animal communities

Green + Blue =

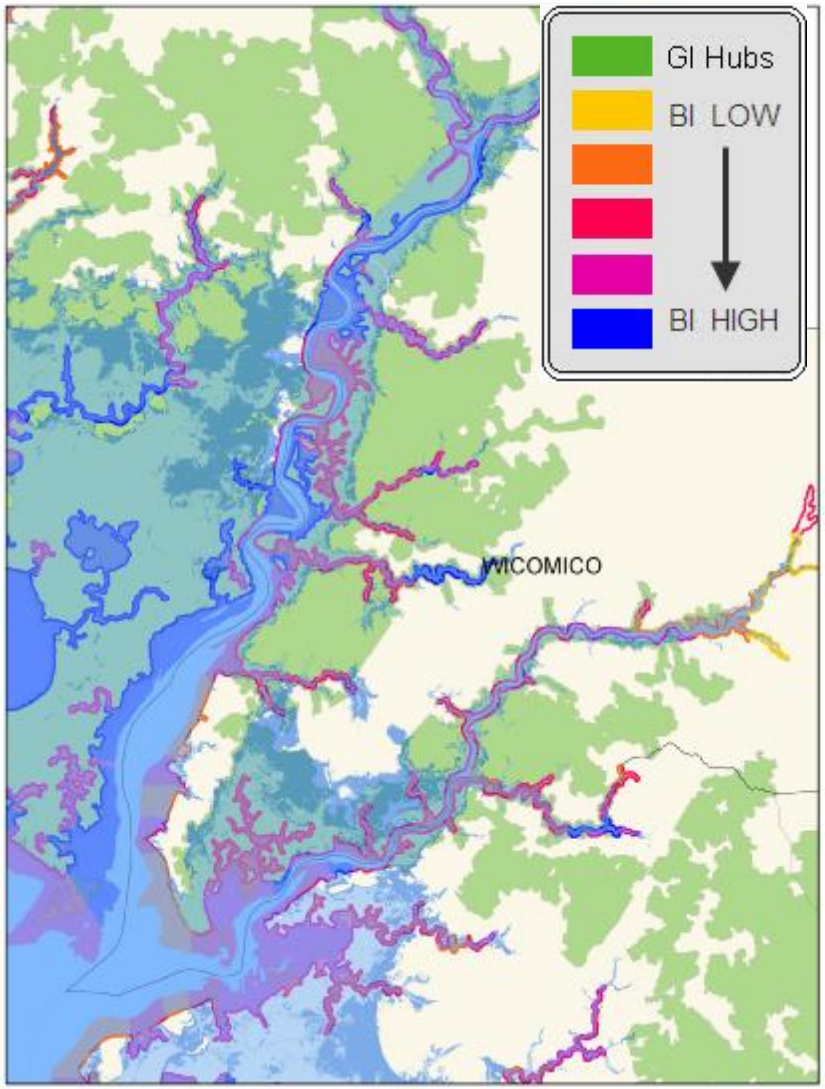


An interconnected ecological network depicting the State's sensitive, valuable and economically important natural resources and habitats as well as the corridors needed to connect them.

Maryland's Risk to Sea Level Rise



[1] MD Scientific & Technical Working Group Report, MCCC, 2008

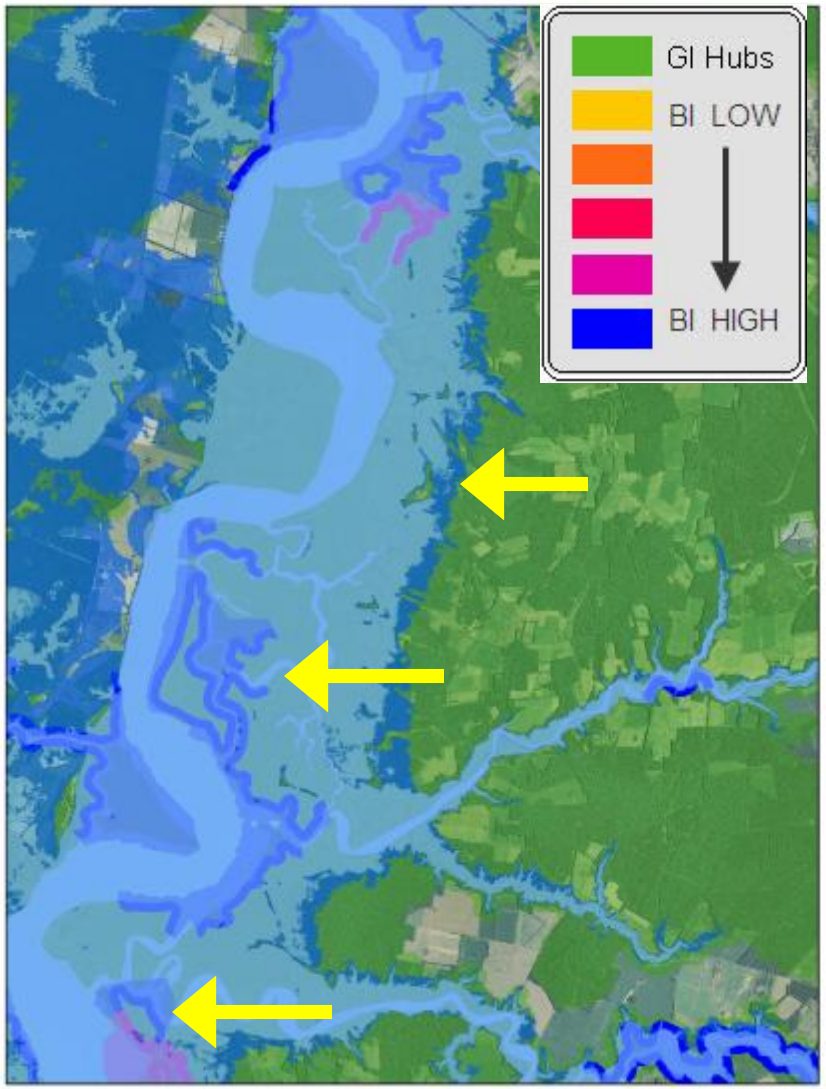


Linking the Green and Blue Infrastructures

Better able to identify critical land-water connections where conservation efforts should be focused to preserve and maintain ecosystem services and conserve valuable coastal habitats and living resources…

Especially when future conditions are considered

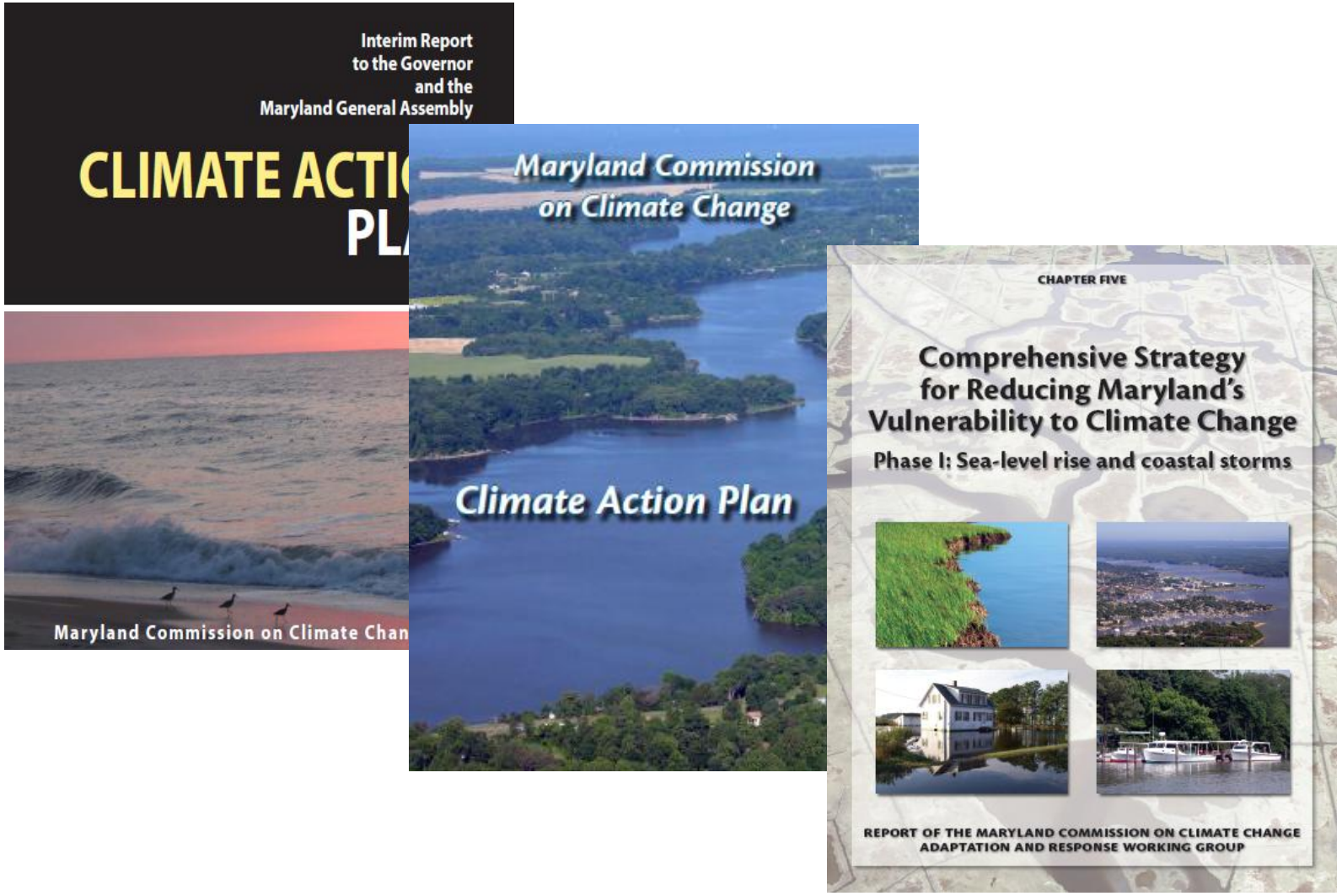
Vulnerability & Opportunity



Recognizing Vulnerability as an Inherent Opportunity

Better understanding of sensitive land-aquatic connections and where their vulnerabilities exist will enhance our ability to increase the resiliency of these systems to accommodate or withstand change over time.

Climate Change Adaptation Planning

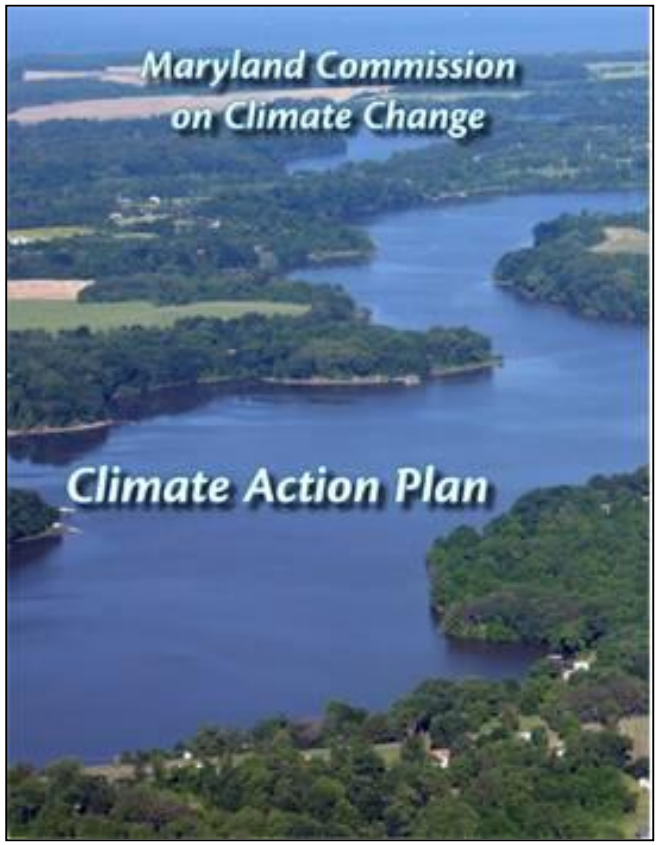


Recommended Adaptation Strategies

Protect Maryland's People, Property, Natural Resource and Public Investments

- Integrated planning for sea level rise
- Adaptation of vulnerable coastal infrastructure (protect, accommodate, retreat)
- Health impact assessments
- Public risk disclosure
- **Forest and wetland protection**
- Sustainable shorelines and buffer area management practices

Natural Resource Protection Policy Recommendation



Priority policy recommendation for the protection of natural resources

- Identify high priority protection areas and strategically and cost-effectively direct protection and restoration activities

- Ability to sustain coastal ecosystem structure and function through restoration and protection activities to ensure that ecosystems can migrate and adapt; and/or

- Ability to sustain coastal ecosystem services that include maintaining healthy Bay water quality and coastal community protection such as flood control and storm-surge protection

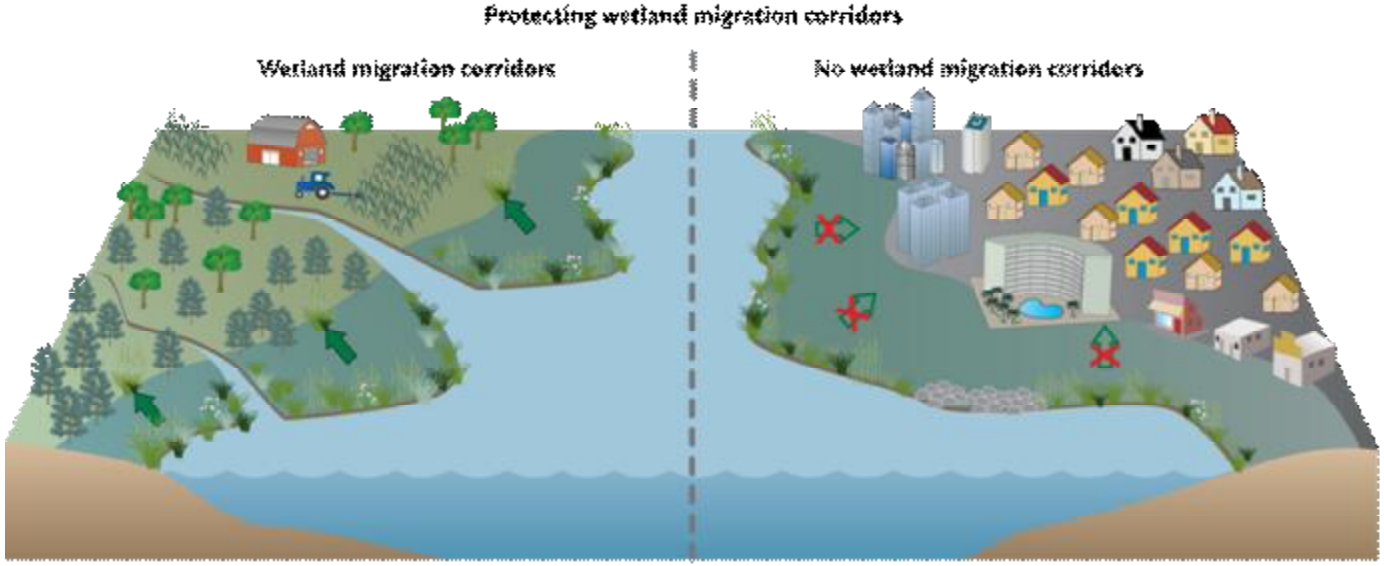
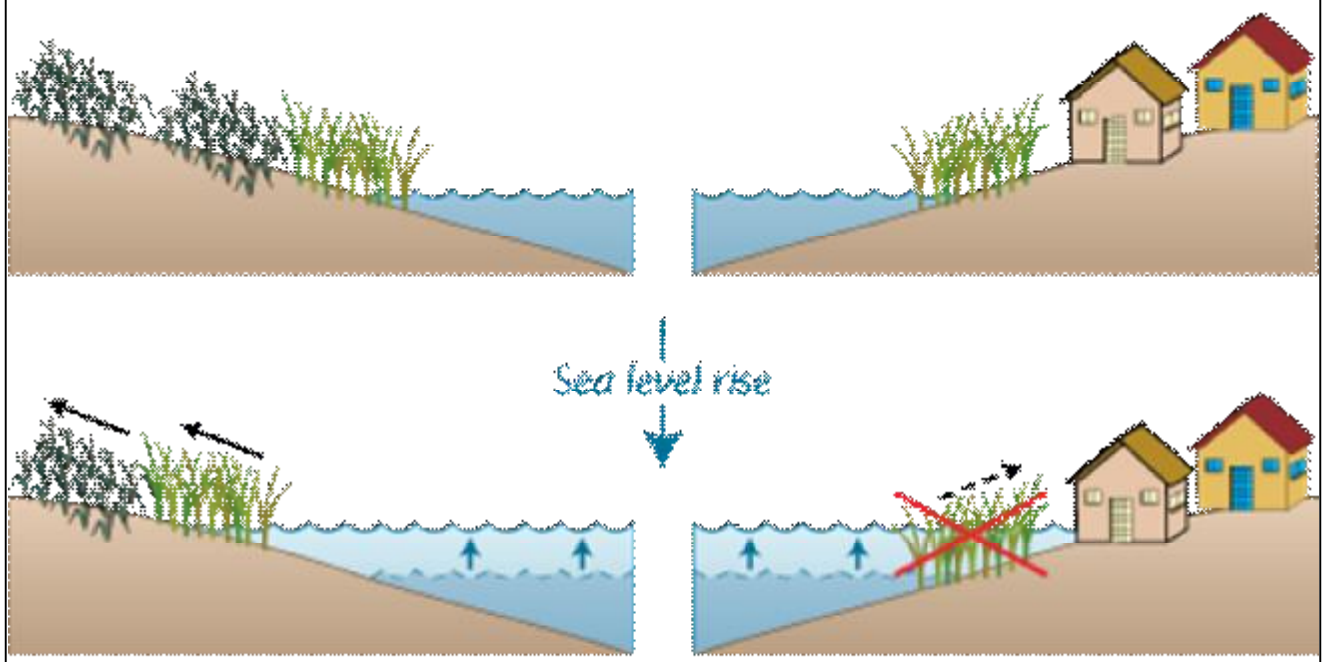


Figure 14. As sea level rises, wetlands may migrate into open spaces such as forests and fields. However, wetlands cannot migrate into areas with man-made barriers such as hardened shorelines and heavy development, such as urban, commercial, and residential areas.

Wetland migration corridor



When upland areas behind marshes contain agriculture or forests, wetlands are able to migrate landwards as sea level rises. When upland areas contain built structures such as houses, wetlands are unable to migrate landwards and consequently drown in place.

Long-Term Goals & Applications

- Identify adaptation strategies and criteria of coastal lands that would inform a mapping project to evaluate lands and their qualities related to SLR adaptation.
- Incorporate mapped areas into Maryland's prioritization and targeting efforts for conservation, protection and restoration activities
- Reduce the vulnerability of natural and human-systems to anticipated impacts of climate change – Land conservation activities play a unique role.

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Catherine McCall

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Questions?